(C) AMENDMENTS TO THE DRAWINGS

Annotated marked-up versions of Drawing Sheets 1 and 3 are provided on separate pages.

Clean versions as replacement sheets of Drawing Sheets 1 and 3 are provided on separate pages.

(D) REMARKS

An amendment is made to the specification to reflect correction of errors in the drawings, discussed below. Paragraphs [0035] and [0080] of the specification are amended to remove references to FIG. 4, which is cancelled. Another amendment is made in paragraph [0079] of the specification to correct a typographical error. The reference to "step 305" in paragraph [0079] is changed to "step 306". Both of these amendments are presented above in section (B) Amendments to the Specification.

Sheets 1 and 3 of the drawings are amended to correct errors in the flowcharts contained in FIGS. 1, 3, and 4. In particular, the flowcharts in FIGS. 1 and 3 are amended to conform to the description of the flowcharts given in the specification, as discussed in further detail below, while FIG. 4 is cancelled.

With reference to amended FIG. 1, the text in steps 103, 104 and 105 of the flowchart are amended to conform to the descriptions of these steps given in the specification in paragraphs [0030], [0031], and [0031], respectively. Thus no new matter is added, since the amended text only contains material already present in the specification as originally filed.

With reference to amended FIG. 3, the flowchart is amended to conform to the description given in paragraphs [0070] to [0075] in the specification as originally filed. In general, steps 301 to 305 in FIG. 3 are amended and renumbered to steps 301 to 306 by adding an additional initial step. In particular, the text in step 301 is added to conform to the description of step 301 in the specification in paragraph [0070]. Additionally, the text in steps 305 and 306 are amended to conform to the descriptions of these steps given in the specification in paragraphs [0074] and [0075], respectively. Thus no new matter is added, since the amended text only contains material already present in the specification as originally filed.

The drawing corrections are presented in section (C). An Annotated Marked-up version and Replacement Sheets for the amended drawings are included.

An Affidavit or Declaration is included with this response stating that the amendatory material in the specification and drawings does not add new matter since it consists of the material already present in the application as originally filed.

Claims 1-8 are pending in the present patent application and all claims are rejected in this Office Action.

In the Office Action, the Examiner first cites prior art made of record, although not relied upon, but considered pertinent to applicant. In particular, the Examiner cites LeBras et al., in U.S. Patent No. 5,392,255, and Pieprzak et al., in U.S. Patent No. US-5,349,527.

The Examiner cites LeBras et al. '255 for a wavelet transform of downward continuation in seismic data migration in the wavelet domain using the velocity layers and velocity and frequency domain equations in lines 5-65 of column 6. However, LeBras et al. '255 discloses a method for depth migration that applies a wavelet transform to a downward continuation operator to create a sparser, and hence more computationally efficient, extrapolation operator, rather than a method for choosing the most computationally efficient extrapolation operator to use, as in the present invention.

In particular, LeBras et al. '255 applies a wavelet transform to the frequency components of a velocity field downward continuation operator, applies a Fourier transform and the wavelet transform to seismic data, applies the wavelet-transformed downward continuation operator to the wavelet-transformed seismic data in the wavelet domain, applies an inverse wavelet transform to the continued seismic data, and sums the inverse transformed data over the frequency components (see, for example, column 4, lines 35-64 and column 10, lines 15-51 of LeBras et al. '255). LeBras et al. '255 discloses using a two-dimensional downward continuation operator with a symmetrically circulant matrix structure (see column 6, lines 51-53 of LeBras et al. '255). However, only one type of operator is used in the method of LeBras et al. '255, rather than choosing different types of operators, as in the present invention. Thus, LeBras et al. '255 neither teaches nor suggests a "method for downward extrapolation of pre-stack seismic data" that includes "determining the type of extrapolation to use in the migration interval", as in the present invention, as embodied in independent claim 1.

The Examiner also cites Pieprzak et al. '527 for a seismic time migration using a stacked downward cubed data volume using the velocity model in figure 6 with the stacking and migration process combined with the equations in lines 20-60 of column 7. However, Pieprzak et al. '527 discloses a method for depth or time migration that applies parallel processing on a massively parallel computer to several steps in migration calculations to increase computational efficiency, rather than choosing different types of operators to increase computational efficiency, as in the present invention.

In Pieprzak et al. '527, the migration steps of downward continuation and updating the depth map are performed independently in each frequency plane or group ("chunk") of frequency planes to take advantage of increased efficiency from using parallel processing (see, for example, column 3, line 41 to column 4, line 5; column 7, line 23 to column 8, line 30; and column 8, line 57 to column 9, line 25 of Pieprzak et al. '527). Pieprzak et al. '527 suggests that it is "feasible" to use different size G operators depending upon frequency and velocity, although a constant size G operator is preferred (see, for example, column 4, lines 24-5 and column 8, lines 30-37 of Pieprzak et al. '527). However, in Pieprzak et al. '527, only one type of operator is used, rather than choosing different types of operators, as in the present invention. Thus, Pieprzak et al. '527 neither teaches nor suggests a "method for downward extrapolation of pre-stack seismic data" that includes "determining the type of extrapolation to use in the migration interval", as in the present invention, as embodied in independent claim 1.

In the Office Action, the Examiner rejects claims 1-8 under 35 U.S.C. §102(b), as being anticipated by Berryhill, in U.S. Patent No. US-5,500,832.

With regard to claim 1, the Examiner states that Berryhill '832 teaches all the limitations of claim 1, in its discussion of figures 1 and 2, particularly in columns 6 and 12. However, claim 1 is a "method for downward extrapolation of pre-stack seismic data", that is, a method of migration. Berryhill '832, alternatively, discloses a method for processing seismic data both before and after migration to provide an alternative to performing DMO correction. In particular, the method of Berryhill '832 (1) converts the seismic data into CMP gathers in the offset domain and (2) converts the data to an epsilon or TANPHI domain. In Berryhill '832, epsilon = ε = SGD / V_{rms}, t, where SGD = offset, V_{rms} = root mean square velocity for corrected time t_0, and t = arrival time. Then, TANPHI = $[\varepsilon^2 / (1- \varepsilon^2)]^{½}$. Epsilon ε is related to the eccentricity of the ellipse defining the reflecting surface for the source and receiver that define the offset.

Continuing, Berryhill '832 (3) converts the converted data into epsilon or TANPHI gathers, respectively; (4) migrates the gathered data using <u>any</u> appropriate type of migration; and (5) converts the migrated data back to CMP gathers in the offset domain (see, for instance, column 4, lines 6-63 of Berryhill '832). Berryhill '832 does not discuss what type of migration to use. In fact, Berryhill '832 states at column 4, lines 56-57 that "[a]ny form of 2-D or 3-D migration process may be employed ..." (see, similarly, no specification of migration method in

column 12, lines 12-13 and line 48 of Berryhill '832). Thus, Berryhill '832 neither teaches nor suggests a "method for downward extrapolation of pre-stack seismic data", that includes "determining the type of extrapolation to use in the migration interval", as in the present invention, as embodied in independent claim 1.

Further, the Examiner states that Berryhill '832 anticipates claims 2-8, in particular, at column 14, lines 30-40, in his discussion of residual velocity analysis (although Berryhill '832 describes the velocity analysis at column 14, line 57 as "effectively, an NMO correction", rather than a type of migration). However, since independent claim 1 is allowable, its dependent claims 2-8 are also allowable.

Thus, the subject matter of independent claim 1 and its dependent claims 2-8 of the present application cannot be derived from Berryhill '832, LeBras et al., '255, Pieprzak et al. '527, or any of the patents cited by the Examiner, alone or in combination, in an obvious way. Therefore, applicant believes that claims 1-8 are ready for acceptance. Further, Applicant believes that the preceding amendments to the specification and drawings place this application in condition for allowance. Applicant respectfully requests the favorable consideration and allowance of this application.

Respectfully submitted,

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Annotated Marked-Up Drawings

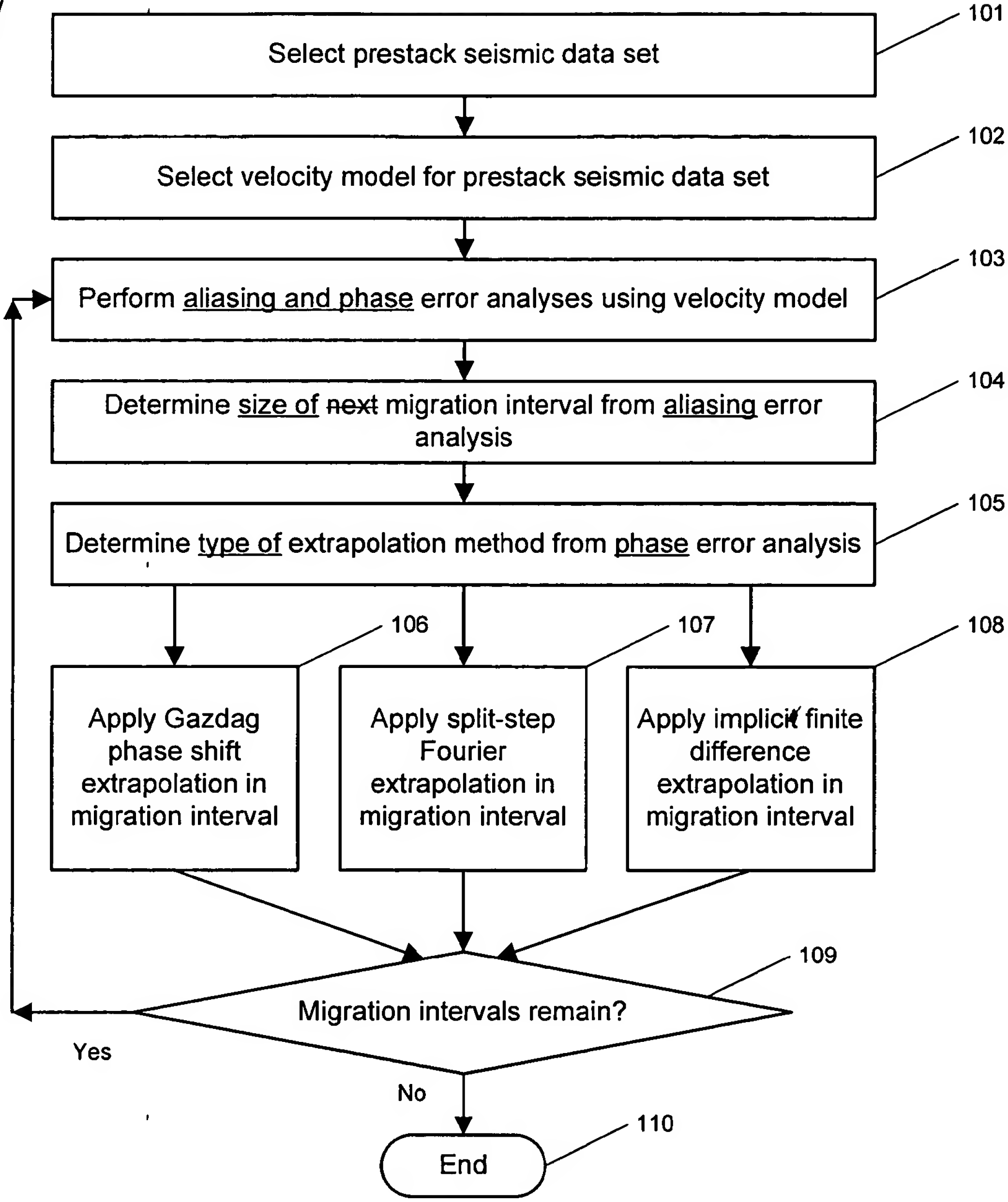

FIG. 1

Annotated Marked-Up Drawings

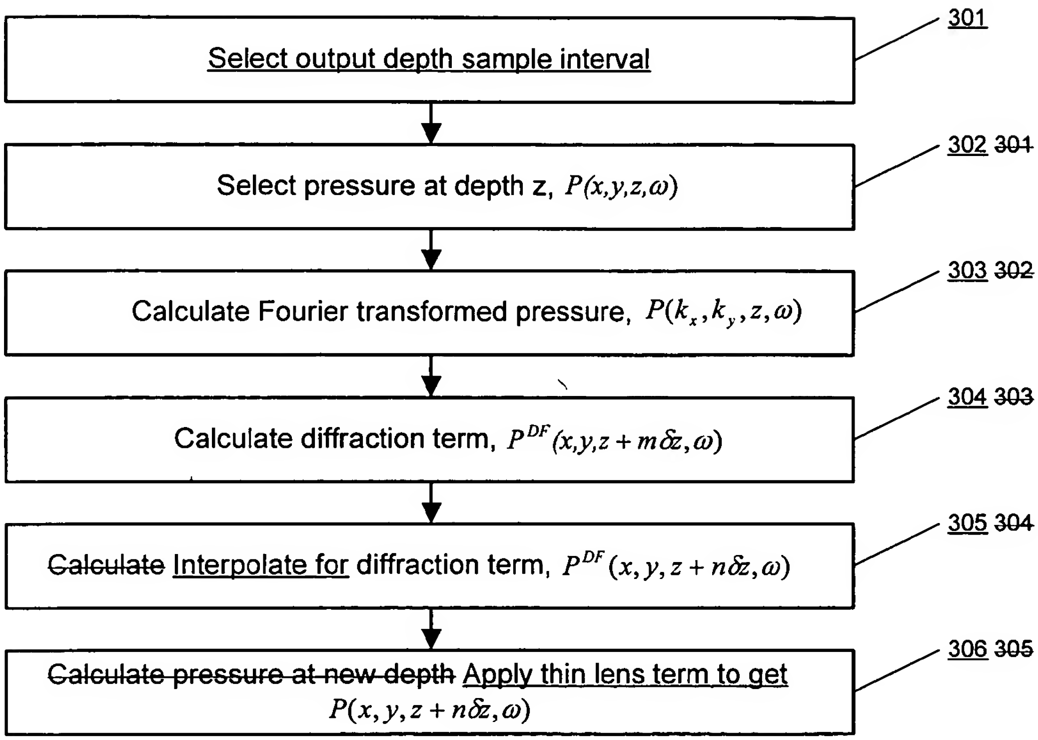

FIG. 3

(Cancelled)

FIG. 4